

CRYOGEN USE AT TA-53 STACK SYSTEMS

Purpose This Meteorology and Air Quality Group (MAQ) procedure describes processes used to fill dewars with liquid nitrogen and maintain liquid nitrogen systems used in the two TA-53 stack monitoring systems.

Scope This procedure applies to individuals from MAQ (Meteorology and Air Quality) and HSR-1 (Health Physics Operations) who are assigned to fill the liquid nitrogen systems at the two TA-53 stack monitoring stations.

In this procedure	Topic	See Page
	General Information About This Procedure	2
	Who Requires Training to This Procedure?	3
	Overview of Process	4
	Filling Supply Dewars	5
	Filling Detector Dewars	6
	Records Resulting from This Procedure	8

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General information about this procedure

Attachments This procedure has the following attachments:

Number	Attachment Title	No. of pages
1	Hazard Review	1

History of revision

This table lists the revision history and effective dates of this procedure.

Revision	Date	Description Of Changes
0	5/9/01	New document.
1	4/6/04	Revisions to crane and cryogen handling steps.
2	4/25/05	Removed steps for use of crane and converted HCP to HR.

Who requires training to this procedure?

The following personnel require training before implementing this procedure:

- Members of MAQ staff deployed to TA-53 to coordinate stack monitoring efforts
- Members of HSR-1 team deployed to TA-53 who are assigned to assist in stack monitoring effort as part of routine maintenance


NOTE: Work authorization applies only to MAQ employees; it is the responsibility of the supervisors of personnel from other groups performing this process to ensure all applicable hazard analyses have been performed according to applicable requirements.

Training method

The training method for this procedure is **on-the-job** training by a previously trained individual and is documented in accordance with the procedure for training (MAQ-024).

General information, continued

Prerequisites In addition to training to this procedure, the following training is also required prior to performing this procedure:

- Cryogen Safety for all users: course #8876
- Facility-specific training for unescorted access to TA-53 experimental areas: course #9693
- Limited access area training to access the ES-2 stack station in the MEB: course #18825 

Definitions specific to this procedure LN: Liquid nitrogen, a common cryogenic fluid. Used at TA-53 stack stations to keep high-purity germanium detectors at near absolute-zero temperatures, thus optimizing their performance.

References The following documents are referenced in this procedure:

- MAQ-024, “Personnel Training”

Note Actions specified within this procedure, unless preceded with “should” or “may,” are to be considered mandatory guidance (i.e., “shall”).

Overview of process

Reason for cryogen use

The major radioactive air emissions from the Los Alamos Neutron Science Center (LANSCE) at TA-53 are radioactive gases. These gases cannot be sampled with “traditional” methods (e.g., capture on sample media) and have very short half-lives. Therefore, continuous monitoring of gaseous radionuclides is required during LANSCE operations.

The best method for discriminating the various components in the emissions air stream is by using a high-purity germanium (HPGe) detector. These detectors must be kept at liquid nitrogen temperatures in order to operate.

Systems using cryogens

The two main emissions stacks for the experimental areas at TA-53 are Building 3M, Exhaust Stack 03, and Building 7, Exhaust Stack 2. In this procedure, these stacks are referenced as ES-3 and ES-2, respectively. Each stack has a primary HPGe detector, referred to as the ES-3 HPGe and the ES-2 HPGe.

Cryogen supply

The Gas Plant at Los Alamos National Laboratory has supply trucks that service TA-53 on a weekly basis (Thursday mornings). Large supply dewars left out in designated areas will be filled by Gas Plant personnel during the weekly supply trips.

Special supply trips can be coordinated with the Gas Plant (667-4406) if needed (e.g., prior to extended holiday shutdowns, etc.). Information such as name, z-number, cost information, and location is required.

Liquid nitrogen dewars

The emissions monitoring program uses two 160-liter “supply dewars” for the primary liquid nitrogen supply. These supply dewars may be used to directly fill the stack detector dewar (30 liter) on the ES-3 HPGe. Currently, however, they are not.

The supply dewars are also used to fill small, 10-liter “transport dewars” with liquid nitrogen. These transport dewars are hand-carried to the stack stations to fill the HPGe detector dewars (30 liter volume).

Filling supply dewars

Supply dewar location Currently, the two 160-liter supply dewars are located in Area A near the southwest roll up door, chained to the cyclone fence.

Filling supply dewar The supply dewars need to be filled approximately every two weeks. Determine if the supply dewar needs filling by examining the floating rod at the top of the dewar. If the rod indicates that less than one third of the supply dewar is remaining, move them outside the Area A southwest roll-up door adjacent to the white (cold trash) trailer.

Filling detector dewars

ES-2 & 3 dewar

There is one 30-liter detector dewar at the ES-2 stack station in Building 7, room 200 (the Mechanical Equipment Building, MEB). Note that there are special access restrictions to enter this room, as described in TA-53 Limited Access Area training.

Supply dewars

One cannot bring the large 160-liter supply dewars into this area, due to access constraints (stairs, etc.). Rather, transport dewars (10-liter) are used to carry LN from the supply dewars to the ES-2 stack station.

Frequency of filling

It is recommended that the detectors be filled every three to four days. The 10 liter transport dewar has enough LN to top off the detector dewars on this frequency.

Required PPE

The following PPE is required for this process:

- face shield
- gloves (available in the locked cabinet in TOFI or box in MEB)
- long sleeves (a lab coat is available in the locked cabinet)
- full-length pants (coveralls can be obtained from the HSR-1 field office or decon trailer)
- steel-toed shoes or boots.

Steps to fill ES-2 & 3 dewars

To fill the ES-2 & 3 dewars, perform the following steps:

Step	Action
1	Obtain at least one transport dewar (approximately 10 liter volume) and the attached hand truck. These dewars are stored in TOFI.
2	Located in the source cabinet is the “L” shaped conduit used to fill the transport dewar from the supply dewar along with the gloves and face shield. Thread the conduit onto valve fitting of the supply dewar.
3	Don PPE as described above.
4	Remove the loose “plug” at the top of the transport dewar. This plug minimizes evaporation of LN and acts as pressure relief for the dewar.
5	Position the transport dewar under the conduit for filling.
6	Slowly open the supply dewar valve. The LN transfer is audible, and vapors from the transport dewar will be visible.
7	When full, shut off the supply dewar.

Steps continued on next page.

Filling detector dewars, continued

Step	Action
8	Replace the loose plug in the transport dewar. Attach bungy cord over plug for transport with the hand truck.
9	Remove the supply dewar conduit and store in the source cabinet.
10	Transport dewar to the ES-2 or ES-3 detector dewars; face shield may be removed for this step.
11	Locate the funnel and tubing, connected to detector dewar.
12	Don cryogenic PPE.
13	Remove the loose plug from the transport dewar.
14	Carefully pour LN from the transport dewar into the funnel.
15	Observe the exhaust dewar vent; vapor should be coming out of this vent as LN is added to the dewar. If nothing is coming out, cease filling the dewar and investigate.
16	When liquid droplets begin coming out of the vent tube, the detector dewar is full. Stop pouring LN into the funnel and wait for funnel contents to drain into detector dewar.
17	Replace the plug in the transport dewar.
18	Replace PPE in the box in the MEB or the source cabinet in TOFI.
19	Make a note on the LN2 log with the time & date the dewar was filled. Also, make an entry in the Stacks log book.
20	Carry the transport dewar back to TOFI for storage.

Records resulting from this procedure

Records

The following records generated as a result of this procedure are to be maintained by TA-53 MAQ staff

- Log of detector LN fill for the HPGe detector dewars at the ES-2 stack and ES-3 stack.

HAZARD REVIEW FOR CRYOGEN USE AT TA-53 STACK SYSTEMS

Work tasks/Steps	Hazards, Concerns, and Potential accidents; Likelihood/ Severity	Controls, Preventive Measures (e.g., safety equipment, administrative controls, etc.)	Hazard Level from IMP 300-00-00 Hazard Grading Matrix
Pour and handle LN according to the steps in the chapters "Filling Detector Dewars" in this procedure.	Liquid nitrogen use: cryogenic burns from skin contact with LN Occasional / Moderate = Low	Wear proper PPE as specified in procedure. Training in cryogenic safety by all individuals filling LN dewars.	Moderate
Perform work tasks in building 7 room 200.	Accident scenario: during operations to the 1L Target, the stack station at Building 7, ES-2 is inside a "Limited Access Area" due to excessive external dose rates encountered if a design basis accident occurs. Remote / Critical = Minimal	Accident scenario: All workers entering the Mechanical Equipment Building (Bldg 7, room 200, location of the ES-2 stack station) during beam operations require TA-53 "Limited Access" area training. All requirements stated in the training shall be followed, including use of supplemental dosimetry as required.	Low

Wastes or residual materials resulting from process

None.

Emergency actions to take in event of control failure

For all injuries, provide first aid and see that injured person is taken to Occupational Medicine (only if immediate medical attention is not required) or the hospital. Notify supervisor and group office as soon as possible. Follow all site-specific emergency plans for any radiation contamination.

Contact LANSCE Central Control Room (CCR) at 667-5729 in any emergency. For radioactive hazards, also contact the HSR-1 Field Office at 667-7069.

